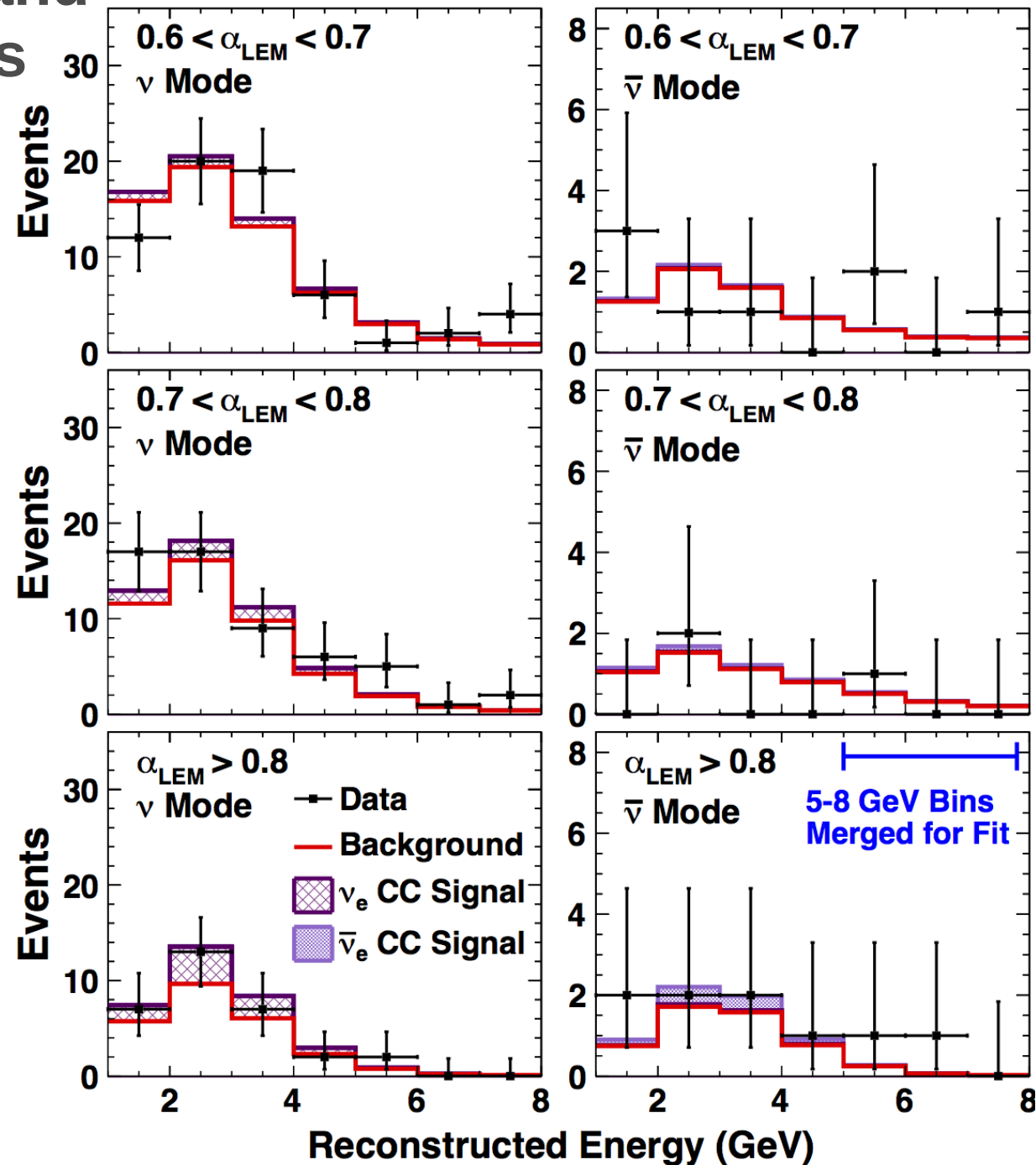# NSI - Electron neutrino and antineutrino appearance

Selected candidate electron neutrino and antineutrino events

The reconstructed energy distributions for three ranges of the LEM selection variable. The plots on the left correspond to data collected in the neutrino beam mode. The plots on the right correspond to data collected in the antineutrino beam mode.

Signal predictions shown here assume $\sin^2(2\Theta_{13}) = 0.051$ and no NSI.

Note we are unable to distinguish between ν_e and $\overline{\nu}_e$ events, so the selected events include a combined contribution of $\nu_e + \overline{\nu}_e$ events.

MINOS Far Detector Data

Legend:
- Data
- Background
- ν_e CC Signal
- $\overline{\nu}_e$ CC Signal

5-8 GeV Bins Merged for Fit

Panels (left, ν Mode): $0.6 < \alpha_{LEM} < 0.7$; $0.7 < \alpha_{LEM} < 0.8$; $\alpha_{LEM} > 0.8$

Panels (right, $\overline{\nu}$ Mode): $0.6 < \alpha_{LEM} < 0.7$; $0.7 < \alpha_{LEM} < 0.8$; $\alpha_{LEM} > 0.8$

Reconstructed Energy (GeV)

Allowed NSI parameter values

The appearance of ν_e events at the Far Detector is sensitive to the NSI parameters $\varepsilon_{e\tau}$ and $\delta_{e\tau}$. These plots show the 90% CL allowed values of $\varepsilon_{e\tau}$ and $\delta_{e\tau} + \delta_{CP}$ assuming a normal hierarchy (top plot) and an inverted hierarchy (bottom plot).

The appearance rate also depends on standard oscillation parameters which are assumed to be the following: $\sin^2(\Theta_{23})=0.5$, $\sin^2(\Theta_{13}) = 0.025$, and $\Delta m^2_{32} = 2.43e\text{-}3 \text{ eV}^2$. The contour is produced by marginalizing over the values of δ_{CP}.

MINOS PRELIMINARY
10.6×10^{20} POT ν Mode
3.3×10^{20} POT $\bar{\nu}$ Mode
Normal Hierarchy 90% C.L.
MINOS Far Detector Data
• NSI Best Fit Point

MINOS PRELIMINARY
10.6×10^{20} POT ν Mode
3.3×10^{20} POT $\bar{\nu}$ Mode
Inverted Hierarchy 90% C.L.
MINOS Far Detector Data
• NSI Best Fit Point